First Image Products from EcoSAR - Osa Peninsula, Costa Rica

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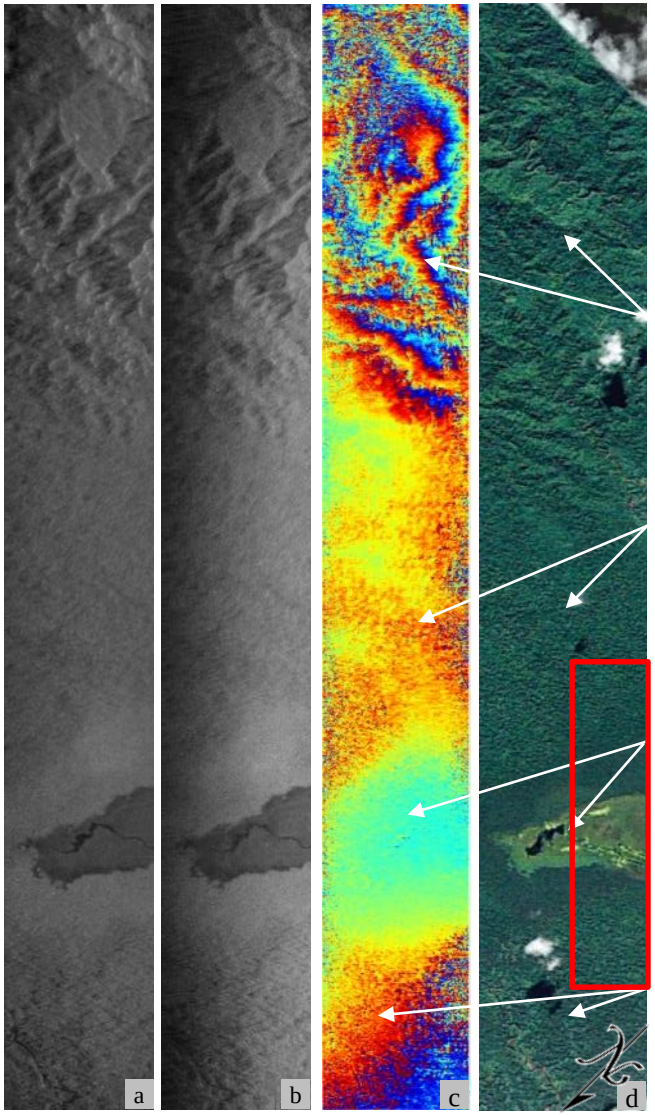

Figure 1

EcoSAR is an advanced airborne polarimetric and interferometric dual antennae P-band (435 MHz) SAR and provides two- and three-dimensional fine-scale measurements of terrestrial ecosystem structure including biomass of dense forest.

EcoSAR collected horizontal and vertical polarized data over a tropical forest area in Costa Rica in Spring 2014.

Preliminary analysis indicates good system performance as efforts focus on improving processing algorithms.

Figure 2

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References:

1. Rincon, R.F., Fatoyinbo, T., Osmanoglu, B., Lee, S., Ranson, K.J., Sun, G., Perrine, M. and Du Toit, C., 2015, May. ECOSAR: P-band digital beamforming polarimetric and single pass interferometric SAR. In 2015 IEEE Radar Conference (RadarCon) (pp. 0699-0703). IEEE.

2. Cloude S. R., Pottier E., "A review of target decomposition theorems in radar polarimetry", IEEE Trans. Geosci. Remote Sens., vol. 34, no.2, pp.498-518, Mar., 1996

Data Sources: EcoSAR, Google Earth

Technical Description of Figures:
Figure 1 (a,b,c,d): EcoSAR [1] single pass InSAR image pair and topographic fringes are displayed from the *right antenna transmit and receive* (H_RH_R) master image and a *left antenna transmit right antenna receive* (H_LH_R) slave image intensity. Fringes from EcoSAR interferogram is shown on the third panel, where the colors indicate wrapped phase values due to topography. The cyan color indicates the extent of the swamp area (topographic low) while the mountains to the right create rapid color cycles due to sloping terrain. Areas of interest are shown with arrows: Tall Forest, Laguna Corcovado, Short Forest, Hills. a) Right antenna intensity b) Left antenna intensity c) Interferogram d) Google Earth.

Figure 2 (e): Pauli decomposition [2] of EcoSAR's polarimetric data shows the first polarimetric decomposition product generated from EcoSAR data using the Corcovado National Park dataset. Polarimetric (Pauli) decomposition are sensitive to forest structure. Detection of tall and short forests are possible.
Area for the polarimetric analysis is shown on Google Earth (d) with a red rectangle. In the figure green color denotes volume scattering, indicating *tall forest*, where red color indicates double bounce scattering, which mostly occurs with *shorter trees* in presence of water. The optical Google Earth and EcoSAR "see" *Laguna Corcovado* differently, even though the canopy-free open water appears dark in both figures. Optical imagery can not easily distinguish between the taller and shorter trees.

Scientific significance, societal relevance, and relationships to future missions:
Designed especially for forest ecosystem studies, EcoSAR employs state-of-the-art digital beamforming technology to generate wide-swath, high-resolution imagery. EcoSAR's dual antenna single-pass imaging capability eliminates temporal decorrelation from polarimetric and interferometric analysis, increasing the signal strength and simplifying models used to invert forest structure parameters. Antennae are physically separated by 25 meters providing single pass interferometry. In this mode the radar is most sensitive to topography. With 32 active transmit and receive channels, EcoSAR's digital beamforming is an order of magnitude more versatile than the digital beamforming employed on the upcoming NISAR mission. EcoSAR's long wavelength (P-band, 435 MHz, 69 cm) measurements can be used to simulate data products for ESA's future BIOMASS mission, allowing scientists to develop algorithms before the launch of the satellite. EcoSAR can also be deployed to collect much needed data where BIOMASS satellite won't be allowed to collect data (North America, Europe and Arctic), filling in the gaps to keep a watchful eye on the global carbon cycle. EcoSAR can play a vital role in monitoring, reporting and verification schemes of internationals programs such as UN-REDD (United Nations – Reducing Emissions from Deforestation and Degradation) benefiting global society. EcoSAR was developed and flown with support from NASA Earth Sciences Technology Office's Instrument Incubator Program.